

THCP sensor

Temperature, Humidity, CO2 and Pressure sensor

(THC sensor doesn't contain the Pressure sensor)

Interior type

Real dimensions



Exterior type



Real dimension

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1. Design

Interior design – manufactured types				
Mark	Display	MPL3115 Sensor	HWS version	Comment
THCPA	Without	NO	THCPA*	
THCPB	4-digitLED	NO	THCPB*	
THCPC	2x16 LCD	NO	THCPC*	
THCPD				Reserved
THCPM	without	YES	THCPM*	
THCPN	without	YES	THCPN*	
THCPO	without	YES	THCPO*	
THCPP	without			Reserved



Exterior design – manufactured types				
Mark	Display	MPL3115A2 Sensor	HWS version	Comment
THCPX	Without	YES	THCPX*	
THCPY				Reserved
THCPZ				Reserved

2. Hardware


2.1 Hardware parameters				
Measurement	Value	Range	Comments	
	Temperature	-40°C ÷ 125°C	In tenth of °C	
	Relative Humidity	0 ÷ 99.9%	In tenth of %	
	CO2	0 ÷ 40000 ppm	Resolution 10 ppm	
	Atmospheric pressure	200 ÷ 1100 hPa	Resolution 0.1 hPa	
Power	8 - 26V DC/ max 0,7W			
Interface	RS485 - MODBUS RTU			
Display	without display or LCD display 2x16 or 4 digit LED display			
Hardware	SHT35 TH sensor, MPL3115 pressure sensor, SCD30 CO2 sensor			
Comm. speed	9600 or 115200 Bd			
Dimension	84 x 84 x 36 mm [w x d x h] - Design for Interior Ø40 x 130 mm Design for exterior			
Design	Interior or exterior			
Color	Black or white for interior, black for exterior			
Setup	Via software Bootloader or via ModBus directly			

2.2 Sending parameters to RS485 after RESET		
	Parameter	Comments
1.row	112:RESET=4<cr><lf>	112 – address (dec), 4 – com. Protocol
2.row	112:SCD30=1<cr><lf>	The CO2 sensor is OK
3.row	112:MPL=1<cr><lf>	The pressure Sensor is OK
4.row	112:SHT=1<cr><lf>	The temperature and the humidity sensor is OK

Display for interior design:

3.1 LCD 2x16 characters with LED light	3.2 4 digit LED
	

3.3 Wiring, standard cable length: 3 m

Wire color	Comment	Or on the PCB for interior design
Green	Ground	
White	12-24V DC	
Yellow	RS485 +	
Brown	RS485 -	

3. ModBus RTU communication protocol

4.1 Command 0x03 Read Registers

Register Number	Parameter
0	Temperature in tenth of degrees from SHT35
1	Relative humidity in tenth of % from SHT35
2	Dew point in tenth of degrees from SHT35
3	◆ Calculated atmospheric pressure in 10 Pa from MPL3115 above the sea level
4	CO2 concentration in ppm from SCD30

◆ if register 108 is set to 0 then value in register 3 is equal with absolute atm. pressure in 10 Pa

4.2 Command 0x03 Read Configuration Registers

Register Number	Register name	Description	Units/Notes
100	Address	1 – 247	
101	Communication speed	0 – 115200, 1 - 9600	Bd
102	HWS version 0	Read Only	TH
103	HWS version 1	Read Only	CP
104	HWS version 2	Read Only	C*
105	HWS version 3	Read Only	:1
106	HWS version 4	Read Only	.1
107	Communication Protocol		1 ÷ 5
108	Altitude above sea level in meter		0 – 4000 m
109	*Active Display time [sec]		10 – 3600, NA

* after pressing the button on the left bottom side the display is for [sec] seconds.

4.3 Command 0x06 Write Registers

Register	Register name	Description	Units/Notes
100	Address	1 – 247	
101	Comm. speed	0 – 115200, 1 - 9600	Bd
102-106	Read Only		
107	Comm. Protocol	1 - INGSIMON 2 – HTML, 3 - MODBUS ASCII 4 – MODBUS RTU 5 – MODBUS TCP	Default: MODBUS RTU (4)
108	Altitude above Sea Level in meter	0 to 4000	Default 0. Can be set to between 0 – 4000
109	Active display time	10 – 3600, NA	NA – endless

4.4 Default parameters

Parameter	Value	Comment
Address	0x70h (112d)	
Communication speed	115200, N, 8,1	
Communication Protocol	0x04	MODBUS RTU
Altitude above sea level in meter	0	
Time for Black Display	60 sec	

4.5 Range of address

Address [dec]	Comment
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1 - 247	For sensors
248 - 254	Reserve
255	Universal address – used only to read registers Writing to registers does not work with this address

4 Examples for Modbus RTU

Example 5.1		
Set the communication speed from 115200 Bd to 9600 Bd for Address 0x70 (112 dec)		
Poll	70 06 00 65 00 01 52 F4	Response with 115200 Bd. In next communication will use 9600 Bd
Response	70 06 00 65 00 01 52 F4	

Example 5.2		
Set the communication speed from 9600 Bd to 115200 Bd for Address 0x70 (112 dec)		
Poll	70 06 00 65 00 00 93 34	Response with 9600 Bd. In next communication will use 115200 Bd
Response	70 06 00 65 00 00 93 34	

Example 5.3		
Read 10 registers from 100 from Address 0x70 (112 dec)		
Poll	70 03 00 64 00 0A 8E F3	
Response	70 03 14 00 70 00 00 54 48 43 50 43 2A 3A 31 2E 31 00 04 00 00 00 28 07 E8	
Meaning:		
Byte [hex]	Description	Comment
70	Address	
03	function code	Read holding register
14	count of bytes (20dec)	
00 70	Address	
00 00	communication speed	115200 Bd
54 48	TH	Temperature, Humidity
43 50	CP	CO2, Pressure
43 2A	C*	With LCD display, * - reserve
3A 31	:1	
2E 31	.1	
00 04	communication protocol	4 - MODBUS RTU
00 00	Altitude from Sea Level	
00 28	Active Display Time	40 sec
07 E8	Checksum	

Example 5.4		
Getting the current address of the sensor with universal address 0xff		
Be aware, that only 1 equipment can be connected to the Modbus network.		
Poll	FF 03 00 64 00 01 D0 0B	Read register 100
Response	FF 03 02 00 70 90 74	70 – equipment's address

Example 5.5		
Changing the address from 70h to 1h.		
Be aware, that only 1 equipment can be connected to the Modbus network.		
Poll	70 06 00 64 00 01 03 34	Write to register 100 value 1
Response	70 06 00 64 00 01 03 34	01 – equipment's new address

The next communication with equipment will be with address 1

Example 5.6		
Changing the address from 1h to 2h. Be aware, that only 1 equipment can be connected to the Modbus network.		
Poll	01 06 00 64 00 02 49 D4	Write to the register 100 value 2
Response	01 06 00 64 00 02 49 D4	02 – equipment’s new address
The next communication with equipment will be with address 2		

Example 5.7		
How to set the Altitude to the value 128 m. Address 70h. Register 108		
Poll	70 06 00 6C 00 80 42 96	Write to the register 108 value 128
Response	70 06 00 6C 00 80 42 96	80h (128d) altitude in m

Example 5.8		
How to set the Altitude to the value 128 m using universal CRC (XX). Address 70h. R.108		
Poll	70 06 00 6C 00 80 58 58	Write to the register 108 value 128
Response	70 06 00 6C 00 80 58 58	80h (128d) altitude in m

Example 5.9		
Reading measured values from 0. register, 5 registers. Address 70h.		
Poll	FF 03 00 00 00 05 90 17	Read 5 registers
Response	FF 03 0A 01 19 02 3F 00 BA 25 B1 01 BF 08 96	
Meaning: 70 – address 03 – function 0A – count of bytes (10 dec) 01 19 → $1*256 + 1*16 + 9 = 281 \rightarrow 28.1 \text{ }^\circ\text{C}$ 02 3F → $2*256 + 3*16 + 15 = 575 \rightarrow 57.5 \text{ \%Rh}$ 00 BA → $0*256 + 11*16 + 10 = 186 \rightarrow 18.6 \text{ }^\circ\text{C dew point}$ 25 B1 → $2*4096 + 5*256 + 11*16 + 1 = 9649 \rightarrow 96490 \text{ Pa} \rightarrow 964.9 \text{ hPa}$ 01 BF → $1 * 256 + 11 * 16 + 15 = 447 \rightarrow 447 \text{ ppm}$ 08 96 CRC		

6.0 Used sensors

6.1 NDIR CO2 sensor technology

- Integrated temperature and humidity sensor
- Best performance-to-price ratio
- Dual-channel detection for superior stability
- Small form factor: 35 mm x 23 mm x 7 mm
- Measurement range: 400 ppm – 10.000 ppm
- Accuracy: $\pm (30 \text{ ppm} + 3\%)$



6.2 Humidity and Temperature Sensor IC

- Accuracy tolerance $\pm 2\% \text{RH}$
- Repeatability $\pm 0.1\% \text{RH}$
- Hysteresis $\pm 1\% \text{RH}$
- Nonlinearity $< 0.1\% \text{RH}$
- Operating Range extended 0 to 100 %RH
- Long Term Drift 5 Typ. $< 0.25\% \text{RH/year}$



6.3 MPL3115A2 precision pressure sensor

- Pressure absolute accuracy $\pm 0.4 \text{ kPa}$ from 50 to 110 kPa over $-10\text{ }^\circ\text{C}$ to $70\text{ }^\circ\text{C}$
- Temperature accuracy @ $25\text{ }^\circ\text{C}$ $\pm 1\text{ }^\circ\text{C}$, over temperature range $\pm 3\text{ }^\circ\text{C}$

